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ENTOMOLOGICAL NEWS

AND

PROCEEDINGS OF THE ENTOMOLOGICAL SECTION

THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

VOL. XXXI. FEBRUARY, 1920. NO. 2.

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Notes on the Lunate Onion Fly, Eumerus strigatus (Dip., Syrphidae)

By F. R. COLE, Bureau of Entomology, Palo Alto, California.

Several articles on the Lunate Onion Fly have appeared recently and Prof. Metcalf's paper (Ent. News, XXX, p. 170–174) gives a good summary of our knowledge of this potential pest in this country. In view of the possible importance of this fly it may be worth while to describe and figure the species and to give certain observations which have been made on its habits.

It is an European species and the larva was recorded in England as early as 1842 by Curtis (Gard. Chronicle, II, 1842). In 1845 Dufour described and figured the larva and two years later Bouché wrote a paper on the early stages, stating that the larvae often destroy whole crops of the common onion. Herold in 1915 (Zeitschr. fur wiss. Inseckten, XI, 345) records great damage to potatoes by the larvae of *E. strigatus*.

The history of *Eumerus strigatus* in this country is a brief one, the first written record being by C. W. Johnson in 1910, and the earliest known capture was at Ottawa, Canada, in 1904 by Dr. Fletcher. In addition to the records given by Prof. Metcalf there are specimens in Dr. Chittenden's collection at Washington, D. C., taken at Oyster Bay, New York, August 24, 1914, with a note "feeding on iris." There are several species common to Europe and the Pacific Coast, but it is very probable that *E. strigatus* is a recent arrival and was first introduced into the Atlantic states in shipments of iris and narcissus bulbs from Holland.

The genus *Eumerus* is a large one and occurs in many parts of the world, sixty species being listed by Kertesz in his Katalog, some of which may be synonyms. There are about thirty species in Europe; five species are known only from Africa and eight species are common to Europe and Africa, *strigatus* being one of these. Species of *Eumerus* have been described from India, China, Hawaii, Asia Minor, Canary Islands, Sicily, Celebes, New Guinea, Australia, Tasmania, Sardinia and St. Helena.

The systematic position of the genus is not very certain; it is near *Xylota* and *Syritta*, having the hind femora thickened, but is also near the *Pipiza* group, certain characters allying it to *Paragus*. The larval habits approximate those of *Merodon*. Verrall says that species seem to him to have some connection with small aculeate hymenoptera, with which they are often found, flying at the outskirts of woods over various flowers, usually in dry and sandy localities.

While at Hood River, Oregon, in 1917, the writer collected a small syrphid flying over grass and flowers at the edge of an apple orchard and it was rather a surprise to recognize *Eumerus strigatus* when sorting over the odds and ends in the killing bottle. It was subsequently noted that there was an onion patch not far from the place of capture. Mr. L. Childs and myself then examined a small onion bed at the Hood River Experiment Station and found in addition to the common onion maggot large numbers of syrphid larvae working in the bulbs. This was on July 20th and during the day

several adults of *E. strigatus* were observed flying about in the sunshine and alighting on the plants; several pairs were taken in copulation at this time. The females were seen crawling into crevices in the ground at the bases of the onion plants and ovipositing in the leaf sheaths just above the bulb. Onions taken from the ground at this time contained several sizes of larvae of both *E. strigatus* and *Hylemyia antiqua*. This material was kept in the laboratory and the surphid larvae pupated in March and April, emerging in late April, and early May, a little later than specimens of the anthomyid maggot from the same bulbs. The small onion bed at Hood River was almost entirely destroyed, an interesting fact, as it is the first recorded instance of this fly attacking onions in the United States. It greatly outnumbered the other onion maggot associated with it.

I have seen specimens of the adult of *E. strigatus* from Forest Grove and Corvallis, Oregon, and also in the collection at Vernon, British Columbia, the latter collected near the large onion farms at Kelowna, B. C., by R. C. Treherne. The species is very probably established as an onion pest in other sections along the Pacific Coast. There may be biological races of the species as in the case of the apple maggot; it has so far confined itself to iris and narcissus bulbs in this country. One of the specimens bred from iris at Oyster Bay, New York, mentioned above, is in the writer's collection; it is smaller than individuals bred from onions at Hood River, Oregon, and the colors are more blue and less green and coppery. The antennae in this specimen are lighter colored and the third joint is narrower.

The larval and pupal stages will not be described at length in this paper. The larvae are quite different in appearance from the common onion maggot, being pale green in color, rather flat and with an ornamented surface having projections along the sides. The posterior respiratory process is bright red. The pupa is light brown when mature and resembles that of *Pipiza*. A description of the adult is given below:

Eumerus strigatus Fallen.

Pipiza strigata Fallen. Dipt. Suec. Syrphici, 618, 1817.

Eumerus grandicornis and *funeralis* Meigen, Syst. Beschreib. III, 208, 1822.

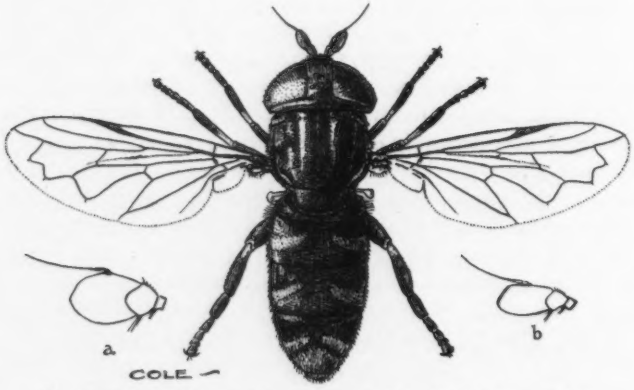
E. lunulatus and *planifrons* Meigen, l. c. III, 209.

E. aeneus Macquart, Soc. Sc. Lille, 269, 1827.

E. selene Loew, Programm Posen, V, 28, and Isis, V, 561, 1840.

Microxylota robii Jones, gen. et sp. nov., Annals Ent. Soc. of America, X, p. 230.

♂.—Vertex rather long, aeneous, with black pile in front a little longer than the second joint of the antenna; the rest of the pile on the head is sparse and yellowish. Eyes with a few very fine white hairs behind and below. Frontal triangle and epistoma gray pruinose, the ground color of the frons obscured. Face dark green in color and white pilose. Eyes touching for a short distance above the antennæ. Antennae blackish, the third joint more brown and distinctly longer than broad; thickly gray pruinose; the basal joints with bristles below (see figure). Occiput slightly swollen above.



Eumerus strigatus Fallen, female. *a*, antenna of female; *b*, antenna of male.

Thorax shining green, punctate, in some places more or less brassy. There are two narrow gray vittae on the dorsum abbreviated behind. The fine short pile of the thorax is yellowish in color. Scutellum colored as the thorax, punctate, the margin finely serrated and with longer pile. Pleura aeneous and white pilose.

Abdomen aeneous, distinctly punctate, with three pairs of lunules or oblique grayish white bands; the gray spaces are a little impressed. Pile of abdomen yellowish or whitish, longest at the anterior corners and at the apex of the fourth segment. Venter with very little green color and with pale hairs.

Legs blackish green, knees and bases of tibiae reddish yellow. Basal joints of middle tarsi with some reddish color. Hind femora much thickened and with two rows of short spines below near the apex; the hind tibiae and metatarsi noticeably thickened. Legs with fine pale hairs, longer on the upper and lower surfaces of the femora. Inner side of apex of hind tibiae with longer yellow bristly hairs. Wings grayish hyaline. Anterior cross-vein oblique and placed beyond the middle of the discal cell. Stigma pale brown. Halteres yellow.

♀.—Very similar to male (see figure). Vertex and frons broad, widening a little below. Frons gray pruinose along the eye margins; hairs black across the ocelli and at base of antennae, but pale elsewhere. Third antennal joint much broader than in the male (see figures) and darker in color.

Length 5.5 to 7.5 mm.

Habitat. This species is distributed through Europe down into Spain and Italy and goes north to middle Sweden and Finland. It is reported from northern Africa and Syria. In North America there are records from Maine, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Ottawa and Quebec, Canada in the east; further west it is reported from Ohio and Colorado and is now known to occur all along the Pacific Coast from California to British Columbia.

Notes on Species of Halictus Visiting Evening Flowers (Hym).

By O. A. STEVENS, Agricultural College, North Dakota.

Halictus (Megalopta?) texanus (Cresson).

1872. *Sphecodes texana* Cresson, Trans. Am. Ent. Soc., v. 4, p. 249.
1887. *Parasphecodes texanus* Cresson, ibid., Supp. vol., p. 292.
1898. *Halictus texanus* Cockerell, ibid., v. 25, p. 185.
1899. *Sphecodogastra texana* Ashmead, ibid., v. 26, p. 92.
1913. *Megalopta* ——— Ducke, Zool. Jahr., v. 34, p. 85.

♀.—Mesonotum rather shining, punctures of moderate size (about 20 microns), separated by scarcely a puncture width laterally and from one and one-half to two times their width medially; basal area of propodeum with about 20 fine, irregular ridges, the angle and truncation smooth; inner spurs of hind tibiae with two to five (usually three, the upper at about the middle of the spur) slender teeth; scopa sparse, inner side of tibiae with rather sparse, long, nearly simple hairs, trochanter and lower edge of femur with only a row of simple bristles, the upper with rather shorter ones.

Blue Rapids, Kansas, June 19, 1919; many females sucking nectar at flowers of *Allionia nyctaginea* and collecting pollen of *Megapterium missouriense*; one female collecting pollen of *Hartmannia speciosa*. Oakes and LaMoure, North Dakota, July 17 to 26, 1919; occasional females sucking at *Allionia hirsuta*, collecting at *Anogra pallida* and *Onagra strigosa*. Sheldon, North Dakota, Aug. 10, 1919; one female at *Allionia hirsuta*. One male at *Helianthus petiolaris* (Sheldon) and one at *Onagra strigosa* (Oakes).

Halictus (Evylaeus) aberrans Crawford.

1901. *Halictus amicus*, var. α Cockerell, Ann. & Mag. Nat. Hist., ser. 7, v. 2. p. 126.

1903. *Halictus aberrans* Crawford, Can. Ent., v. 35, p. 336.

1903. *Halictus galpinsiae* Cockerell, ibid., p. 342.

♀.—Thorax with sparse pubescence which is griseous or somewhat ochraceous; sculptured as in *H. texanus*, the propodeum more finely wrinkled; mesonotum shining, the punctures of variable size (about 15 to 25 microns); pubescence of the abdomen of both appressed and erect hairs in variable amounts; segments 2 to 4 usually with both basal and apical bands, the basal of appressed hairs, the apical of both appressed and upright; second segment with basal patches at the sides; sides of the first and more or less all of the other with scattered upright hairs; first segment smooth and shining, appearing impunctate in some lights and very minutely punctate in others; posterior legs as in *texanus*, inner spurs of tibiae with about five teeth.

♂.—Puncturation similar to that of female, pubescence more sparse especially on the abdomen which is scarcely at all banded; face sometimes with appressed hairs and sometimes with erect hairs predominating; seventh segment of abdomen slightly indented at apex; tibiae and tarsi yellow, the median half of middle and posterior tibiae brownish black, the anterior more reddish brown.

North Dakota, 28 females, 48 males at various places from Valley City westward to Williston and Marmarth, June 16 to Sept. 20 (mostly in June and July); females collecting pollen from flowers of *Gaura coccinea*, occasionally from *Onagra strigosa*, and sucking nectar at flowers of *Gaura coccinea*, *Lactuca pulchella*, *Helianthus petiolaris*, *Grindelia squarrosa*, *Sideranthus spinulosa*, *Solidago mollis* and *Symphoricarpos occidentalis;* males at flowers of *Allionia hirsuta*, *Allionia lanceolata*, *Gaura coccinea*, *Brassica juncea*, *Symphoricarpos occidentalis*, *Chrysopsis villosa*, *Grindelia squarrosa*, *Helianthus petiolaris* and *Lactuca pulchella*.

My first specimens of this species were 2 females and 9 males taken at Dickinson, by Mr. C. H. Waldron, at flowers of *Helianthus petiolaris* on Aug. 13, 1912. These, together with a female from Valley City, Aug. 13, 1912, at *Sideranthus spinulosus* were determined by Mr. Crawford as *H. aberrans*. Later when females were found collecting pollen at *Gaura* in the evening, I suspected the identity of *aberrans* and *galpinsiae*. Cockerell has stated (Proc. Ent. Soc. Wash., v. 9, p. 119) that "the stigma (of *galpinsiae*) is a lighter, brighter orange than in *aberrans*." Crawford in his table of species of *Halictus* (Journ. N. Y. Ent. Soc., v. 15, pp. 183–189), has separated the females on slight difference in puncturation of mesonotum and first segment of the abdomen, the males upon the nature of the hairs of the face ("appressed scale-like" in *galpinsiae*).

The North Dakota specimens agree well with Cockerell's description of *galpinsiae* and I cannot separate the ones taken at other flowers in the daytime from those taken at *Gaura* in the evening. A paratype female of *galpinsiae* sent by Prof. Cockerell agrees with the North Dakota specimens. The Dickinson specimens are in rather poor condition, the hairs being more or less matted by moisture. A female taken at Sentinel Butte on *Grindelia* in mid-afternoon is indistinguishable from the *Gaura* specimens. Mr. H. L. Viereck has kindly examined a cotype of *aberrans* in the U. S. National Museum and finds the scopa as here described.

Halictus (Evylaeus) oenotherae new species.

♀.—Length 9 to 10 mm., black with sparse, short, pale pubescence, which inclines to yellowish, especially on the legs. Face subquadrate, the front closely and finely punctured, clypeus smooth and shining with sparse shallow punctures; antennae reddish beneath. Mesonotum rather dull, the punctures of moderate size, separated by less than a puncture width laterally and scarcely more than that medially; propodeum shining, with prominent, somewhat irregular, sharp ridges; laterally these continue over the rounded edge while medially they are interrupted by a ridge; the truncation rugulose and surrounded by a ridge. Posterior legs as in *texanus*, the hairs of the tibiae somewhat more numerous and a few longer ones on the femur; inner spur of tibiae with four slender teeth; wing nervures light brown, the stigma, subcosta and median dark; first recurrent received one-fifth basad of second cubital; second submarginal narrowed only slightly above. Abdomen smooth and shining the first segment very

minutely punctured, the sides of first and second, apex of second and all of the following with thin pubescence which forms faint apical bands.

Blue Rapids, Kansas, June 20, 1919; 5 females at flowers of *Megapterium missouriense*, nearly an hour after sunset.

Type No. 12033, will be placed in the U. S. National Museum. Paratypes in collections of Prof. T. D. A. Cockerell, Prof. M. H. Swenk, and the writer.

A species similar in appearance to *H. aberrans* Cwfd.; slightly larger, mesonotum a little more closely punctured, pubescence of abdomen more scanty, the appressed type nearly absent. Differing very much in the sculpture of the propodeum which is similar to that of *H. pectoralis* Smith, to which it would run in Crawford's table (Journ. N. Y. Ent. Soc. 1907). It is quite different from *pectoralis* in its larger size and characteristic scopa.

The sparseness of the scopa, especially that of the femur, which is characteristic of these three species is evidently an adaptation to the collecting of onagraceous pollen.

Halictus (Evylaeus) swenki Crawford.

1906. *Halictus swenki* Crawford. Ent. News. v. 17, p. 275. ♀

Truncation of propodeum with rounded angles, basal area medially with a few irregular ridges which reach about half way to the angle, laterally with faint striae which reach the angle. Second submarginal cell narrowed fully one-half above, first recurrent nervure interstitial, or very nearly, with second cubital.

♂.—Length about 7 mm. Similar to the female, thorax more smooth and shining. Face subquadrate, little narrowed below; clypeus not produced, only gently rounded; mandibles slender, their tips reaching nearly to the bases of the opposite ones; apical half of clypeus and basal middle, labrum and basal two-thirds of mandibles, pale yellow; antennae reddish yellow beneath for entire length, joint 4 as long as 2+3, the latter about equal. Legs reddish yellow, anterior and middle femora at base, most of posterior femora and tibiae, dark brown on outer side; tarsi pale.

In the sand hills near Sheldon, North Dakota, Aug, 6 to 21, 1916–19. Allotype No. 12317. About a dozen females and twenty males, chiefly at flowers of *Allionia hirsuta* and *Petalostemon villosum*, also at *Linum rigidum* and *Hieracium scabriusculum*.

The male is noteworthy for the low, broad clypeus. Of the species which I have, only *H. forbesi* Rob. is similar in this respect.

Generic Position of Halictus texanus

As shown by the synonymy, this bee has been referred to various genera by different writers. The manner of pollen collecting permits a reduction of scopa which may account for its being originally placed in *Sphecodes*. Ashmead created the new genus, *Sphecodogastra*, for it on account of the enlarged ocelli. Ducke has referred it to *Megalopta* Smith, together with about a dozen little known South American species.

If we reduce *Evylaeus*, *Chloralictus*, etc., to subgenera I think *Sphecodogastra* also should be reduced. Except for the large ocelli it would not be separated from *Evylaeus*. This character has been associated with its crepuscular habits and similar examples in other genera cited. The other species here discussed, however, do not show such a character altho they have similar habits; it may be noted also that the bumblebees of the subgenus *Bombias* have larger ocelli than those of the subgenus *Bombus*. Ducke separated *Megalopta* from *Halictus* on the characters of enlarged ocelli and night flying habit, altho he does not separate *Agapostemon*, *Augochlora* and other groups. Such disposition seems scarcely tenable.

The ocelli of *texanus* are about twice the diameter of those of other *Halicti* of similar size. Those of *aberrans*, *oenotherae* and *swenki* seem a trifle larger but not appreciably so. I have examined several species (females) with the following results.

Approximate lateral diameter of anterior ocellus:

H. texanus (Cress.)	400 microns	*H. forbesi* Rob.	200 microns
H. aberrans Cwfd.	200–220 microns	*H. swenki* Cwfd.	180 microns
H. oenotherae Stevens	200 microns	*H. ligatus* Say.	150–200 microns
H. lerouxii Lep.	180–200 microns	*H. provancheri* DT.	150 microns

Visits of Halictus texanus to Flowers.

I had been very much interested in Graenicher's account (Bul. Pub. Mus. of Milwaukee, v. 1, pp. 222–225, 1911) of the unusual habits of *Sphecodogastra*, and an opportunity to verify them came on June 20, 1919, at Blue Rapids, Kansas. I found many females sucking nectar at flowers of *Allionia nyctaginea*. The time was not noted but must have been about an hour before sunset. The principal evening prim-

rose flowering there at that time was *Megapterium missouriense*. The flowers of this are yellow, 10–15 cm. wide; anthers about 1.5 cm. long, the pollen grains large and so well joined by cobwebby threads that they may be brushed off easily in one mass.

No exact time was obtained for either the first or last opening of the flowers or visits of the bees, but the flowers seemed to begin opening a little after sunset and many times bees were seen flying about the flowers not yet opened. Most of the flowers observed, opened in the earlier part of the evening. The stigma is exserted some minutes before the flower opens and the bees crawl about it searching for an opening in the bud, so that ample opportunity for cross pollination is provided. In case of one flower, at least ten or twelve visits were made before the flower opened; at one time three females were on the bud, one attacking and driving away another. They attempted to force their way into the apex and sides of the bud, flying away after some seconds. In no case was there any evidence of biting into the flower.

As soon as a small opening appeared at the tip of the flower, a bee would force her way in and begin collecting. Often they forced only a partial entrance and then withdrew. The flowers were quickly stripped of pollen so that after one or two bees had collected at a flower, later visitors flew away after a brief inspection. The pollen was gathered into a large mass which seemed to be carried chiefly between the posterior legs. On account of the darkness it was impossible to follow the flight of the bees. The last visits were about an hour after sunset (8:40 P. M. standard central time).

The principal other evening primrose flowering at that time in that locality was *Hartmannia speciosa*. The flowers of this species are white, 5–10 cm. wide, otherwise similar to those just described. They are not so strictly evening flowering as they open earlier and remain open longer in the forenoon. One trip was made to a place where these grew half a mile from where the other notes were taken. At sundown many of the flowers were open and their pollen undisturbed. During 15 or 20 minutes stay a single female was taken at the flowers collecting pollen.

At Oakes and LaMoure, North Dakota, July 17–26, 1919, several females were sucking nectar at flowers of *Allionia hirsuta*, about an hour after sunset. Searching the evening primroses for them I found females collecting pollen at *Anogra pallida*. Careful watching of a single large plant each of *Anogra pallida* and *Onagra strigosa* showed the flowers of the former beginning to open about 8:40 P. M. (sunset at 8:00), those of the latter about 9:00 P. M. A female flew about both plants 20 minutes before the flowers began to open. As soon as those of *Anogra* began to open the bees were at work quite as described at *Megapterium*. One female was taken collecting at *Onagra*, but this did not seem to be visited as much as *Anogra*. A brief visit at 9:30 showed no bees and the next morning I found that no flowers of *Anogra* had opened after that hour altho rather more of the *Onagra* flowers had opened later than before that hour. A male was found in an *Onagra* flower at sunrise on July 26th. Another had been taken in the early forenoon at Sheldon, N. D., Aug. 21, 1918, at *Helianthus petiolaris*.

Cockerell (Trans. Am. Ent. Soc. v. 25, p. 185, 1898) has recorded this bee at flowers of *Senecio douglassii* and *Pyrus communis* in New Mexico, and Crawford (Can. Ent., v. 35, p. 336, 1903) at *Grindelia*, but the time of day is not stated. At Manhattan, Kansas, Aug. 28, 1907, I took two females at flowers of *Mentzelia decapetala* (an evening flowering plant) at 7:30 P. M. This plant is not native there. At Williston, North Dakota, on Aug. 15, 1915, I visited this plant in the early evening but found none of these bees and scarcely any of other species.

Visits of Halictus aberrans to Flowers

In North Dakota this bee is a regular visitor of *Gaura coccinea* from an hour or more before sundown until dark. Both sexes visit it for nectar altho the males visit chiefly the flowers of *Allionia*. A few females have been taken collecting pollen of *Onagra strigosa* in the forenoon and visiting several other flowers for nectar both evening and morning or even well toward mid-day. At Oakes on July 18, 2 females and 9 males

were taken at *Symphoricarpos* an hour after sunrise; at the same place on July 24 one of each sex at the same flowers about half an hour before sunset. No females, however, were found at *Allionia* where most of the males were taken.

The flowers of *Allionia hirsuta* seemed to open about an hour before sunset and were withered by sunrise next morning. Those of *Gaura coccinea* open some time before sunset. They are white, about 6–8 mm. wide, petals narrow, anthers only about 2 mm. long, the pollen scanty and not so well cohering as in the species previously described. *Meriolix serrulata*, a day-flowering species, has yellow flowers, the pollen scarcely at all cohering. A number of plants of it stood with open flowers and undisturbed pollen near the place where the bees were found at *Symphoricarpos* in the morning. In the case of *aberrans* the pollen is carried between the inner sides of the posterior tibiae and femora.

No observations were made upon *H. oenotherae* farther than that the females were visiting *Megapterium* in the late evening with *H. texanus*. Two specimens have some pollen on their legs.

Visits of H. swenki to Flowers

This species has been included chiefly because many of both sexes were found at *Allionia hirsuta* at Sheldon on Aug. 10, 1919. This was during the hour before sunset. Shortly after sunset a number of plants were examined and only a single female found. The first specimens taken were several males at the same place, Aug. 13, 1916, on *Petalostemon villosum:* I had collected nearly all day at these and other plants, but took none of *H. swenki* until these in the late afternoon. At the same place, Aug. 21, 1918, two or three of each sex were taken in the early forenoon at *Linum rigidum*.

Hours of Flight of the Species mentioned.

Further data are needed to show to just what extent these bees are "night flying." Those so far available tend to show that *texanus* extends its work farthest into the night, at least until quite dark. This, according to my observations, was necessitated by the time of opening of the flowers visited for

pollen. The bees were flying as much as an hour before sunset, and quite likely may be found occasionally still earlier. For *oenotherae* only the one record is available, two of the specimens having been taken as late as any of *texanus*.

The flowers of *Gaura* visited by *aberrans* open earlier, and the bees are able to complete their work earlier, their time of greatest activity seeming to be at about sunset. This species is found quite frequently at other times of day. For *swenki*, the hour preceding sunset appears to be the time of greatest activity, altho it may also be found at other times of day. I do not know where the females collect pollen, but do not believe it is from the *Onagraceae*, as their scopa is of the ordinary type, the femora having long hairs with slender branches, arising from the two edges and meeting over the posterior surface.

Other Visitors and Notes on the Flowers.

At Blue Rapids, I took also at *Allionia nyctaginea*, females of *Halictus forbesi* and both sexes of a *Chloralictus*. At Sheldon at *A. hirsuta*, *H. forbesi* and male of *Agapostemon texanus*. At Lisbon, North Dakota, Aug. 8, 1919, a worker of *Bombus separatus* Rob. collecting pollen of *Gaura coccinea* just at sunset; at Fargo, N. D., workers of *B. ternarius* Say. and *B. fervidus* Fab. sucking nectar at *Onagra strigosa*. *Gaura coccinea* is regularly visited at dusk by brown moths of medium size (*Noctuidae?*) and I have seen the ruby-throated humming bird at both *Onagra strigosa* and *Anogra pallida* in North Dakota.

An interesting point bearing upon the controversy of attraction by color or smell is brought to notice. The bees (*H. texanus*) were observed flying about the flower buds before any sign of opening was visible. It scarcely seems possible that they could then be attracted by either color or odor. The odor of the freshly opened flowers of *Anogra* is strong and heavy, quite noticeable at a distance of a meter. The opening of the flower was sudden, a small cleft appearing at the apex, increasing to 6 or 8 mm. in a few minutes, then suddenly opening wide (in perhaps 15 or 20 seconds).

A group of *Onagra* plants were examined at intervals at Fargo, North Dakota, on Aug. 1, 1919, the number of open flowers removed each time were:

8:30 P. M.—6	11:00 P. M.—0 (3 nearly open)
9:00 P. M.—48	Aug. 2.
9:30 P. M.—29	6:00 A. M.—28
10:00 P. M.—16	9:00 A. M.— 0
10:30 P. M.—12	12:00 M.— 0

No bees were seen and none of the species described are known to occur in that locality.

Some Notes on the Occurrence of Delphacinae (Hemip. Homop.)

By C. S. Spooner, Urbana, Illinois.*

During several years the writer has spent considerable time collecting Hemiptera, making a special effort to obtain specimens of Delphacinae. In the course of this collecting he has been impressed with the fact that the species of this sub-family usually occur in what might be termed "pockets"; small areas, differing but slightly from the surrounding environment, very rich in genera and species.

The following notes will serve to substantiate this. While collecting at Middletown, New York, in July, 1910, the writer took a number of species in a pasture east of the city. The pasture was bordered on the east and for a few yards on the south by woodland. In the southeast corner of the pasture the following species were taken: *Liburnia campestris* VanD., *L. lutulenta* VanD., *L. osborni* VanD., *Pissonotus brunneus* VanD., *P. marginatus* VanD., and *P. divaricatus* Spooner.

The species of *Liburnia* were found in fewer numbers over the rest of the pasture but the others were found nowhere else. Perhaps in this case, the increased shade afforded by the trees was responsible for the localized occurrence.

*Contributions from the Entomological Laboratories of the University of Illinois, No. 60.

In July, 1911, while collecting in the valley of the St. Croix River in Chisago County, Minnesota, a small area embracing only a few square yards was encountered in which specimens of *Otiocerus degeeri* Kirby, *O. abbotti* Kirby, *O. coquebertii* Kirby and *Amaloptera uhleri* VanD. were taken. No derbids were taken at any other place during the trip and this particular spot differed in no essential particular from much of the ground covered.

The next and most striking example was seen at De Witt, Mitchell County, Georgia. The banks of the Flint River in this region are lined by timber for a distance varying from a hundred feet to several hundred yards from the margin. At one point a partial clearing had been made from the timber edge to about one-half way to the river, a distance of perhaps fifty feet. This clearing covered an area of from fifteen to twenty square yards. It had become overgrown with various weeds, shrubs and some rather young second growth timber.

In this clearing, on two consecutive days, July 23–24, 1912, the following Delphacinae were taken: *Phyllodinus flabellatus* Ball, *Liburniella ornata* Stål, *Amaloptera fitchii* VanD., *Cenchrea uhleri* Ball, *Oecleus sp.*, *Dictyophora florens* Stål, *Thionia bullata* Say, *Acanalonia conica* Say, *A. bivittata* Say, *Ormenis pruinosa* Say, *O. septentrionalis* Spin., *Pissonotus brunneus* Vand. var (?).

A visit was paid to this same spot the following year when most of the species were again taken. The most conspicuous difference noted was the total lack of specimens of *Phyllodinus flabellatus* Ball which were very abundant the previous year.

Other clearings, apparently similar to this one and only short distances from it, lacked all or most of these species. In my notes I designated this spot "Fulgorid Haven" and many subsequent trips were made to it. The majority of the pecies were again collected on these later trips.

Again at Thomasville, Georgia, a small locality rich in species of Delphacinae was found. Here a small stream widened into a pond with swampy banks, the banks rising

gradually through a narrow meadow to long-leaf pine timber land, some of which had been cleared. A small bridge crossed the stream at the east end of the pond. The eastern half of the meadow, north of the bridge proved a very fertile collecting ground. The collecting here extended over the whole season of 1915. The following insects were taken here: *Myndus* sp., *Oliarus* sp., *Bruchomorpha* sp., *Thionia bullata* Say, *Acanalonia bivittata* Say, *Cenchrea uhleri* Ball, *Stenocranus sacchari-vorus* Westw., *S. angustatus* Crawf., *Bostaera nasuta* Ball, *Pissonotus binotatus* Spooner, *Pissonotus* sp., *Phyllodinus brunneus* VanD. var (?), *Liburniella ornata* Stål, *Liburnia andromeda* VanD., *Liburnia slossoni* Ball, *Liburnia puella* VanD., *Liburnia. magnistyla* Crawf., *Liburnia* sp., and *Dicranotropis* sp.

The insects in this unusual list were almost wholly confined to the north east side of the pond. A few species were found at other points around the pond but other ponds apparently similar and in the same general locality lacked the greater number of the species.

The explanation of these "pockets" is not at hand. The answer undoubtedly lies in the results of a very careful analysis of the environment. A plant census should be taken of one of these "pockets" and compared with similar areas which lack the insects; at the same time comparisons should be made of the humidity, rate of evaporation, light intensities and temperatures of the different localities.

On the next occurence of this kind which comes to the writer's attention, he hopes to be able to make a study of this character. These notes are published with the hope of stimulating investigation along these lines, since they appear to be most important in the study of insect distribution.

Specific, Subspecific and Varietal Categories of Insects and the Naming of them.

By W. L. McAtee, U. S. Biological Survey, Washington, D. C.

Current practice appears to recognize as satisfactory bases for the recognition of groups of specific rank, non-intergrading

differences in structure and in color pattern. Structural characters are preferred, those of the genitalia often being used; color is less reliable, for even strikingly different color patterns may prove to intergrade when an abundance of material is examined.

Species though they may not intergrade with each other, each may include a smaller or larger number of intergrading forms. It is with reference to these that nomenclatorial practice varies most. Entomologists will do well to profit by the experience of workers in ornithology and mammalogy, in which sciences the problems connected with taxonomic categories subordinate to the species have long received attention resulting in a generally accepted usage. The *subspecies* is freely used; it is a geographic race, a part of a species marked by average differences in characters which intergrade with those of subspecies occupying different, though usually adjacent parts of the general range of the species, along the common boundary of which intergradation is complete.

It has sometimes been urged that the amount of difference decides whether a form should be called a species or a subspecies, but this is hardly true except in cases where the differences are small and intergradation while not actually observed is *assumed* to occur. In general practice, intergradation clearly is the criterion. Even minute differences known to be non-intergrading are satisfactory for specific diagnosis, while characters apparently more important which vary so that intergradation is evident can be used only for the differentiation of categories of lower than specific rank.

These statements while in the form of dogmatic assertions are not so intended; they merely epitomize the practice that has grown up under the guidance of the Code of Nomenclature of the American Ornithologists' Union, which may be looked upon as a parent to the International Code. As a matter of fact individual systematists differ widely in the importance they attach to the various crtieria for the diagnosis of species and subspecies, as intergradation or the contrary, amount of difference, and geographical isolation or the reverse. Some discussion of these features may be profitable.

Since submitting the present paper for publication, an article on "Criteria for the Recognition of Species and Genera" by Dr. C. Hart Merriam* has appeared. In it the author says: "To my mind, the *criterion of intergradation* is one of the most pernicious that has ever been introduced into the systematic study of animals and plants" (p. 7); and he asks: "If species and genera *** are to be set aside because of the discovery of intermediate forms does it not follow that sooner or later our classification is doomed to destruction, chaos taking the place of system?" (p. 9). If I have properly gathered the message of Dr. Merriam's paper as a whole, it is, that since classification is an essentially arbitrary thing, it may as well be arbitrary throughout, including its principles and practices. We may all agree, or it would appear that we should be able to agree, that scientific classification is arbitrary, in that it consists of organized concepts, and that the concepts must have a certain definiteness. We may go further and say with respect to the systematist, that to avoid setting too high a value upon the characters of taxonomic groups, and to escape mistaking conceptions for realities, he must ever keep in mind that systems are essentially arbitrary or artificial. At the same time, paradoxical though it may seem, he must shun artificiality. It hardly requires stating that the more highly artificial (arbitrary) is the classification of any group the less satisfactory. A system which merely pigeon-holes specimens without taking into account their fundamental relationships and probable lines of evolution, is not a worthy contribution to modern taxonomy. An attempt must be made to reflect nature and this can be done only by full recognition of the facts of organic evolution, among which, one almost omnipresent, is intergradation, or if that term seems to exclude hybridism from a possible share in the intricacies of relationships, we may use the phrase approximating variations, of related groups.

But it is certainly unreasonable to apprehend that such recognition involves the end of everything like our present sys-

*Journ. of Mammalogy, Vol. 1, No. 1, Nov. 1919, pp. 6–9

tems of classification. Have we not, for generations, and in the face of a growing recognition of the principle of intergradation, retained as more or less definite conceptions, such bird families as the finches, and the tanagers,* and this despite the existence of forms so intermediate in their relationships that they have frequently been shifted from one group to the other? The intermediates may have been buffeted but the families have not been scrapped. Somewhat the same situation holds for the plant families, Rubiaceae (cleavers, bluets, etc.) and Caprifoliaceae (viburnums, honey-suckles and the like), two large and important groups, for the separation of which no absolutely trenchant character has as yet been pointed out; nevertheless lumping has not ensued. Citing an example among genera, who can say definitely where the crane-fly genus *Tipula* leaves off and its ally *Nephrotoma* begins? Yet they are kept as separate concepts by specialists in those flies, if for no other reason, than the convenience of reducing, in some way, the enormous *Tipula* complex.

The trend of modern taxonomy is so strongly toward subdivision that fears as to the linking up of numerous groups on account of the recognition of intermediates, are certainly premature. Indeed our present systems of classification have been built up with the principle of intergradation as one of the most important aids in the work. Both the original and the revised codes of Nomenclature of the American Ornithologists' Union, affirm *intergradation to be the touchstone of trinomialism*, yet the number of recognized forms of North American birds has not decreased, but on the contrary, has constantly grown. There has been a net increase of 42 genera, 34 species and 211 subspecies in forms recognized in the first (1886) to the third (1910) editions of the American Ornithologists' Union's Checklist of Birds. Evidently they have not been lumped wholesale because of the principle of intergradation. And why? precisely because it has been used

*For further data as to the intergradation of the families of oscine birds, which nevertheless retain their family rank, see Ridgway, R., Birds of North and Middle America, Part I, 1901, pp. 17–18, and 24–25.

arbitrarily, or if you prefer, with discretion. It has been a guide not the commander of the advance.

Carried out logically, recognition in taxonomy of the principle of intergradation decides another much debated point—the status of island races, or even of those inhabiting separate continents. If individual variations are such that overlapping of all the differential characters occurs, the forms should be regarded as subspecies; if not, they are properly considered as species. These conclusions, also, are not universally accepted. To some naturalists, obvious isolation as of island forms, and real or assumed isolation of continental races, apparently is taken as proof of specific distinctness. For the purpose of throwing light on this view we may consider the case of certain birds of the perennially interesting Galapagos Islands. Within the limits of a single and evidently very plastic genus—*Geospiza*—there are species confined to a single island, or to two islands, and so on, up to 11 islands in the highest number recorded by Snodgrass and Heller.* What is a more cogent argument in the case, there are also *subspecies* that occur in just the same way, some of them upon only a single island, others upon two or more up to a maximum of eleven. Here is definite proof drawn from forms wholly of one highly plastic genus that a single subspecies actually ranges throughout a considerable number of well-separated islands, to certain of which at the same time, other subspecies and even species, among its congeners, are entirely restricted. In other words, the case proves, that isolation in itself is not admisssible as a decisive factor in giving specific rank to organisms.

If such is the case when the isolation is that of islands separated by stretches of water in some instances of considerable width; if such isolation is not accurately reflected in the relationships of the animal inhabitants, what weight can be given to alleged cases of isolation on continental areas, where knowledge that the isolation is real, is difficult if not impossible, to obtain?

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*Proc. Wash. Ac. Sci. Vol. 5, pp. 231–372, January, 1904.

It would certainly seem that to use isolation as a reason for calling forms species, although they overlap through individual variations, is entirely out of harmony with taxonomic principles that must guide the student in cases where isolation does not enter into the equation. Rather the nature of the characters must be relied upon, and according to the general view, previously set forth, intergrading forms must be given no more than subspecific rank, even though they inhabit apparently isolated localities.

Subspecies have not been very extensively used in entomology, for the sufficient reason that existing collections, in most cases, do not furnish enough material to enable the student to decide whether intergradation in characters of recognizable forms does occur, or if it does whether the forms have more or less separable ranges. However, work should be directed toward the recognition of subspecies, for the subspecific system of nomenclature is of too great value in expressing the facts of relationship and geographic distribution to be ignored.

The category of variety has been very extensively used in entomology, but in a number of distinct senses; for instance, it has been used to designate variants in size, structure and color and varying ranks of all of these. Often no doubt the form so designated is a subspecies or geographic race, but information warranting a positive decision on this point is lacking. Care should be taken, however, to make sure whether the evidence will not permit a more definite disposition of the form.

Color forms that occur more or less throughout the range of a species are frequent among insects, apparently more so than in any other group of animals. In mammals melanistic forms occur, in birds these dark forms also are found, as well as in certain cases reddish and grayish forms, but the practice has been not to recognize these in nomenclature. In the case of color forms, however, it seems necessary to go a step farther in entomology than has been done in the taxonomy of the warm-blooded vertebrates.

A very cogent reason for believing certain types of color varieties of insects to be distinct in character from color phases

in vertebrates, and therefore requiring different taxonomic treatment, is the fact that the insect body is composed of highly distinct (and so far as normally colored surface is concerned of entirely separated) parts which may vary independently in color, and to which certain colors may be sharply restricted, conditions vastlv different from what may be observed in connection with the continuous body covering of most vertebrates. Two individuals of the eastern ruffed grouse, for example, may agree in practically every detail of color pattern, yet one be distinctly gray, the other decidedly rufous in the general tone of its plumage. This type of color variation is represented among insects by the red and yellow color phases of various species of *Erythroneura* (Jassoidea; Eupterygidae). Nevertheless these very insects exhibit another type of color variation in which certain markings may occur on the pronotum, scutellum, or other division of the body, in a certain series of specimens of both sexes, and be entirely lacking in another series, all of which, however, belong to what is considered a single species.

It being true that very distinct color forms in a structurally homogeneous complex, the species, are not unusual in insects, sorting and naming them would seem to be demanded* by the practical considerations of making a collection appear to have really been classified, and to have names by which the forms can be referred to in exchanging and in recording notes upon them. If they are left unnamed no phase of studying them will advance so rapidly, nor will final understanding of them be reached so soon, as will be the case if they are described and named.

Naming these color varieties of insects is further desirable because of the fact that due to lack of material there is no certainty in many cases that the form may not be a subspecies. A characterization and a name which will enable others to record similar specimens will bring out facts necessary to decide

*See also Parshley. H. M. Psyche, Vol. 25, No. 3, June, 1918, p. 65, and Occasional Papers of the Museum of Zoology, University of Michigan, No. 71, August, 1919, pp. 5-6.

upon the subspecific rank or otherwise of the form, information that for lack of a name, and of point in publishing the records might not become available for years, if ever.

An apparent difficulty in naming color forms is that in a species having both subspecies and varieties, it is conceivable that the same color variety may occur in different parts of the range and therefore in more than one subspecies. This condition, if reflected in names, would require a quadrinomial nomenclature and it indicates that the color variety does not deserve taxonomic recognition similar to that accorded subspecies. However it seems more likely to the writer that this very difficulty points out the distinction between mere color phases and varieties as he has become acquainted with them among insects. If the color form does occur throughout the range of a species and is proved to exist in different subspecies, then it may be considered a color phase and left unnamed. If, on the contrary, the color variety does not cross subspecies, it is not a color phase, and may be named.

Summing up, a variety in entomology, actually of less than specific rank, may be one of three things: (1.) It may be a true subspecies or geographic race, present material being insufficient to decide the point; (2.) It may be a color phase, that is, albinistic, melanistic, erythroic or the like, an appearance it may assume anywhere in the range of the species that may affect all subspecies alike (proof of its nature) but which usually is recognizable as a phase of a simple color gradation, often as the alternative of two color states as albinism and melanism, and it should not have a name that will have to be reckoned with in scientific nomenclature; and (3) it may be a variety such as is known in many insects that cannot be subspecific in its nature, because unrelated to distribution, that does not answer to the definition of color phase, here given, but the real nature of which admittedly is not understood. It seems to the writer that these varieties have the importance, and in a way the attributes of subspecies except correlation with geographical distribution, and that they should be named. From a purely nomenclatorial point of view the fact that we do not know what color varieties really

are is unimportant, and the writer's contention is, that we shall be much longer learning what they are, unnamed, than if named.

Discovery of their real nature is work for an institution having extensive facilities for insect breeding, and is a project most systematists would like to see undertaken.

Some insect varieties may have a genetic significance which when understood will indicate the proper taxonomic treatment. It is possible, even probable, that some varieties may be found, also, to be correlated with definite food plants or peculiar local habitats. Proof of such a relation would call for recognition of a new type of subspecies in which the geographic element of subspecies, as at present recognized, would be replaced by an ecologic factor—in other words it may become necessary to recognize two sorts of subspecies—namely geographic and ecologic.

Some discussion touching upon personal experiences in connection with insect varieties may perhaps be pardonable. The writer has freely named color varieties and has had it called to his attention that others could not commend his activities in this direction. Regarding the varieties in question, the comment has several times been made: "But they all run together." Of course they do, otherwise they would have been ranked as species not as varieties. This remark illustrates the lack of definite conceptions on the part of some entomologists of the nature of the subordinate taxonomic groups, and is one reason for the writing of this paper.

When a large proportion often as high as 90% of the individuals of a color variety can be sorted out without any hesitation as to their similarity to each other and as to their distinctness from coordinate groups of the species complex, in the writer's opinion, they should be named. Intergrading specimens may be placed with the variety to which they are most similar, not left standing about like wall-flowers. Intergrades should bring consternation neither to the careful systematist nor to the neat curator. They are inevitable, should be taken frankly for what they are and treated accordingly. In all consideration of taxonomic categories, it should

not be forgotten that no one is bound to accept and use them any further than he likes. If he prefers to stop at good old-fashioned species (in some cases this means groups of modern species) he may do so, or if his taste permits he may go on to true subspecies; if constituted like the writer he will pursue differentiation (of categories not of individuals) to the limit the available material will permit, but will expect no one to follow beyond a point in harmony with his individual point of view.

So much off the text; returning to minor taxonomic groups, it is submitted that the following definitions appear to accord with the best modern usage. If a group of similar individuals, or an individual presumed to represent such an assemblage, is distinguished from another by one or more non-intergrading characters of whatever kind, it is regarded as a species, and its range may be anything that climate, geography, geological history, commerce or fate may have accorded it. If its essential characters intergrade with those of another form from which it has a more or less separate range, it is called a subspecies. If its characters intergrade and it occupies no definite area to the exclusion of related forms it is a variety. Simple melanistic and albinistic varieties or comparable forms, are called color phases and usually have not been recognized in nomenclature.

(*To be Continued*)

Coleophora apicialbella nom. nov. (Microlepid.)

The name *Coleophora apicialbella* is here proposed for the species of *Coleophora* described in this journal, Vol. XXX, p. 109, 1919, under the name *Coleophora apicella* preoccupied by *Coleophora apicella* Stainton of Europe. ANNETTE F. BRAUN, Cincinnati, Ohio.

A Correction in the Mecopodinae (Orthopt.)

Figure 10, pl. ii and fig. 1, pl. iii of Fascicule 171 of Wytsman's Genera Insectorum on the Mecopodinae are reversed. The first really represents the ♀ of *Mecopoda elongata* Linn. while the latter represents the ♂ of *Mossula basalis* Caud. A. N. CAUDELL, Washington, D.C.

ENTOMOLOGICAL NEWS

PHILADELPHIA, PA., FEBRUARY, 1920.

ENTOMOLOGY AT THE CONVOCATION WEEK MEETINGS OF 1919-20

The programs of the meetings of scientific societies held between December 29, 1919, and January 3, 1920, for which we have data, list 128 papers on entomology, or at least on insect material; 118 of these were to be given at St. Louis; 10 were read at Princeton, New Jersey.

Of the societies meeting at St. Louis, Section F of the American Association for the Advancement of Science and the American Society of Zoologists were jointly credited with 15, 1 of these (by invitation) being on polyembryony and sex, 2 on cytology, 6 on genetics, 4 on ecology and general physiology and 2 on comparative anatomy. The cytological papers were based on Tettigidae, those on genetics on *Drosophila*. As 1919 was a great event in the 17-year cicada calendar, this insect supplied material for one physiological and one anatomical paper.

The Entomological Society of America provided 11 titles on ecology and general physiology, 3 on comparative anatomy and 2 on taxonomic groups. Of special interest was the symposium: "The Life Cycle in Insects," treated by taxonomic groups, by nine speakers (Messrs. Folsom, E. M. Walker, Ball, Fracker, Chapman, C. L. Metcalf, Cockerell and Forbes and Dr. Edith M. Patch), and the annual address before the Society, this year by Dr. W. J. Holland, on "The Evolution of Entomological Science in North America."

The American Association of Economic Entomologists furnished the great bulk of entomological papers—73 including President W. C. O'Kane's address, "The Day's Work." Among these were 2 on mosquitoes, 1 on ticks and 1 on external parasites of stock and poultry, 2 on the pink bollworm, 3 on corn borers, 9 on insecticides, 12 on various aspects of beekeeping (in the Apicultural Section), 6 before the section of

Horticultural Inspection, 3 on the codling moth, 4 on leaf-hoppers, 1 on the chinch bug and 2 on the Hessian fly.

The Botanical Society of America listed two papers on ants (on their relations with fungi and on galls produced by them), The American Phytopathological Society one on leaf hoppers and hopperburn of potato leaves and the Ecological Society of America one on the ecological succession of insects in stored food products.

At Princeton, the American Society of Naturalists heard 2 papers on cytology (Orthoptera) and 7 on genetics (6 of them on *Drosophila*). The symposium was on "Some Relations of Biology to Human Welfare," to which Dr. W. M. Wheeler contributed an informing and highly amusing paper on "Biology and Society" in the form of a supposed letter to the speaker from a king of the West African *Termes bellicosus*, describing the social organization of his community and contrasting it with human society to the disadvantage of the latter.

In the Convocation Week meetings of 1918–19 but 64 entomological papers were presented, as a result of war conditions. This year's total of 128 is well up toward the previous high record of 139 papers for the New York meeting of 1916–17.

Notes and News

ENTOMOLOGICAL GLEANINGS FROM ALL QUARTERS OF THE GLOBE

A Suggestion for a Better Popular Name for the Fulgoridae (Hemip.).

So far as I am aware the only common name that has ever been suggested for members of the Family Fulgoridae is "lantern Flies," based upon the supposition that a large South American species emits light. Regardless of the merits of the arguments which have been advanced pro and con in this case, the members of this family generally do not emit light; the term lantern flies is, therefore, an evident misnomer. Therefore, regardless of the fact that the name lantern flies is rather well established for this family it would seem advisable to replace it by some other name and I would suggest Plant Hoppers as being perhaps the most suggestive name available, thus bringing the common name of the

family in line with the common names of other closely related families, *e. g.*, Tree Hoppers (Membracidae), Frog Hoppers (Cercopidae), and Leaf Hoppers (Cicadellidae). The only other use of the name plant hoppers, so far as I am aware, is as a general name for these four families, but it seems to me that each family is of sufficient importance economically, and sufficiently distinct taxonomically to command a separate name. The Family Fulgoridae is coming into such prominence economically that it would seem advisable to have a common name for the family as a whole, and, so far as is consistent with good usage, use this name in connection with the various species. Thus: Sugar cane plant hopper, not sugar cane leaf hopper; corn plant hopper, not corn lantern fly. It is not intended to imply, however, that all common names for members of this family should end with the expression plant hopper, for such names as cranberry toad bug are distinctive and having the right of priority might be used, although the name toad bug is suggestive of species of the subfamily Gelastocorinae (Galgulidae), and the name cranberry plant hopper is equally distinctive, equally short and even more suggestive of the character of the insect.—Z. P. METCALF, State College, West Raleigh, North Carolina.

Change of Name

We are requested to announce that Alex Kwiat, of Chicago, Illinois, has changed his name to Alex K. Wyatt. Address: 2445 Eastwood Ave., Chicago. Correspondents please note.

Entomological Literature.

COMPILED BY E. T. CRESSON, JR., AND J. A. G. REHN.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species, will be recorded.

The numbers in HEAVY-FACED TYPE refer to the journals, as numbered in the following list, in which the papers are published.

All continued papers, with few exceptions, are recorded only at their first installments.

The records of papers containing new species are all grouped at the end of each Order of which they treat.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

1—Proceedings of the Academy of Natural Sciences of Philadelphia. **2**—Transactions of the American Entomological Society, Philadelphia. **6**—Journal of the New York Entomological Society. **10**—Proceedings of the Entomological Society of Washington, D. C. **11**—Annals and Magazine of Natural History, London. **12**—Journal of Economic Entomology, Concord, N. H. **13**—Journal of Entomology and Zoology, Claremont, Cal. **19**—Bulletin of the Brooklyn Entomological Society. **22**—

Bulletin of Entomological Research, London. **33**—Annales de la Societe Entomologique de Belgique, Brussels **50**—Proceedings of the United States National Museum, Washington. **62**—Bulletin of the American Museum of Natural History, New York. **85**—The Journal of Experimental Zoology, Philadelphia. **100**—Biological Bulletin of the Marine Biological Laboratory, Woods Hole, Mass. **102**—Broteria. Revista Lusco Brazileira. Serie Zoologica, Braga.

GENERAL. Cleare, L. D.—A useful breeding cage. **22,** x, 43–4. **Harris, E. D.**—Obituary by C. W. Leng. **6,** xxvii, 237–40.

GENETICS, ETC. Seyster, E. W. —Eye facet number as influenced by temperature in the bar-eyed mutant of Drosophila melanogaster. **100,** xxxvii, 168–80.

ARACHNIDA, &c. Brooks, F. E.—A migrating army of millepeds. **12,** xii, 462–4. **Ewing, H. E.** —Stable flies and chiggers. **12,** xii, 466.

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